

## A NEW SPECIES OF QUERCUS IN ARIZONA

CORNELIUS H. MULLER

In 1948 there came to my attention a specimen collected in the Ajo Mountains of Pima County, Arizona, which was identified with considerable misgiving as *Quercus turbinella* Greene. Recently two series of collections from the same locality were referred to me by Dr. John M. Tucker of the University of California (Davis), who had requested Dr. K. F. Parker of the University of Arizona to obtain the specimens for him. Dr. Tucker furthermore furnished me with notes derived from specimens at the Pomona College Herbarium indicating a similar oak in the Castle Dome Mountains and the Kofa (S.H.) Mountains of Yuma County, Arizona.

A close examination of the Ajo Mountain material suggested kinship with the series *Glaucoidae* Trel. of Mexico (to which *Q. hinckleyi* Mull. of Texas had been referred). Its distinctness from *Q. turbinella* was apparent. Two joint field studies with Dr. Tucker in the Ajo Mountains and subsequent visits to the Castle Dome and Kofa Mountains confirmed in my mind the differences between *Q. turbinella* and the population of the Ajo Mountains. However, certain features of the Ajo population (notably the prominent spinose teeth of the leaf margins) are so strikingly at variance with the series *Glaucoidae* that the description of a new series is required.

**Quercus ser. Relictae ser. nov.** Frutices vel arbores, ramuli gracili glabri vel tomentosi pruinosi, gemmae rotundae minutae, folia sempervirentia coriacea glauca glabra vel sparse pubescentia aristato-dentata, petioli brevi, fructus annuus parvus pedunculatus, cupula squamis levis crassis, glans oblonga vel ovoidea ad basim solum cincta.

Rhizomatous shrubs or low trees with slender glabrous or pubescent pruinose twigs and minute buds and apically persistent stipules; leaves small or minute, glabrous or nearly so and strikingly glaucous, microscopically papillose beneath, prominently toothed and attenuately spinose; fruit small, the shallow cups with small scales, the oblong to ovoid acorns glabrous or apically pubescent and included at the base only.

Desert mountains of the southwestern United States and possibly adjacent Mexico. Includes *Q. ajoensis* sp. nov. (the type) and *Q. hinckleyi* Mull. (Contr. Texas Research Found. 1: 40, pl. 11. 1951). The *Relictae* are closely related to the *Glaucoidae*, and especially to *Q. perpallida* Trel. of that series in which also the lower leaf epidermis is papillose but in which the teeth are not spinose.

**Quercus ajoensis** sp. nov. Arbor mediocris vel frutex, ramuli 1-2 mm. crassi sparse brevi-stellato-pubescentes glabrati pruinosi, gemmae 1-1.5 mm. longae ovoideae vel rotundae, folia sempervirentia coriacea ovata vel lanceolata 1.5-3.5 cm. longa 1-2 cm. lata apice acuta basi cordata vel rotundata utrinque 5- vel 6-attenuato-spinoso-dentata glauca et glabra

vel rare subtus sparse fulvo-puberulenta et ad basim costis utrinque stellato-pubescentia, lamina subtus minuto-papillosa, petioli 3–4 mm. longi sparse stellato-pubescentes, fructus annuus brevi- vel longi-pedunculatus, cupula 6–8 vel 10 mm. lata 3–4 mm. alta squamis appressis, glans 1.25–1.5 cm. longa 0.5–0.7 cm. lata oblonga vel angusto-ovoidea glabra apicem exceptis ad basim solum cincta.

Small trees or shrubs (along intermittent waterways and on high north-facing slopes), reaching 10 m. in height with trunk diameters to 6 dm. (usually smaller); trunks branched at or near the ground level; branches ascending or broadly spreading, the bark thin, scaly (almost flaking) or furrowed, light gray. Twigs ca. 1 (rarely 2) mm. in diameter, light brown and usually inconspicuously short-stellate-pubescent, rarely conspicuously gray-tomentulose, glabrate or the pubescence variously persistent, gray in age or mottled with russet. Buds very inconspicuous, 1 to 1.5 mm. long, ovoid or irregularly rounded, brown or russet, glabrous or the outer scales lanate with short simple hairs; the stipules caducous, but persistent about the terminal bud, ca. 3 mm. long, ligulate, pubescent. Leaves evergreen, persisting 1 or 2 seasons, rather coriaceous, ovate to narrowly ovate or rarely lanceolate, 1 or usually 1.5 to 3.5 or rarely 5 cm. long, 0.5 or usually 1 to 2 or sometimes 3 cm. broad, apices acute or rarely obtuse (except the setaceous apical tooth), bases cordate or rarely rounded, each side with 5 or 6 (sometimes more or fewer) strikingly long-attenuate spinose-aristate teeth, upper surface glaucous green, glabrous or sparingly stellate-pubescent along the midrib, lower surface waxy glaucous, the epidermis microscopically papillose, glabrous or sparsely stellate-pubescent along the midrib or sometimes minutely and sparsely golden-puberulent on the lamina, margins crisped between the teeth or sometimes flat, prominently cartilaginous; veins 5 to 8 on each side, as many as the teeth and terminating in them or with prominently branching intermediates, raised on both surfaces but more prominently so beneath; petioles 2 to usually 3 or 4 mm. long, slender, reddish (especially beneath at the base) or merely greenish-white or yellowish throughout, stellate-pubescent like the twigs or more sparsely so. Staminate catkins 2 to usually 4 cm. long, rather loosely flowered on a tomentulose peduncle, the 4 to 6 anthers exerted from the sparsely pubescent and ciliate perianth. Pistillate catkins 1.5 to 2.5 or even 5 to 7 cm. long, 2 to 4 flowers variously scattered or terminally grouped on a sparingly stellate-pubescent or nearly glabrous slender peduncle. Fruit annual, solitary or paired on peduncles 3 to 5 or more cm. long (or as short as 0.5 cm.); cups thin, 6 to 8 or rarely 10 mm. broad, 3 to 4 mm. high, shallowly cup-shaped, the scales with appressed glabrous brown subligulate apices, the bases moderately thickened and tan-pubescent or rarely densely gray-tomentose; acorns 1.25 to 1.5 cm. long, 0.5 to 0.7 (rarely 0.9) cm. broad, oblong to narrowly ovoid, apically somewhat narrowed or pointed, glabrous except for the dense apical tomentulum about the persistent styles, included at the base only.

ARIZONA. Pima County, Organ Pipe Cactus National Monument, Ajo Mountains: waterway of Arch Canyon, just opposite and north of Santa Rosa Mountain, elevation 3,200 feet, April 27, 1953, *Muller and Tucker 9547, 9548*; just opposite and south of The Spire, elevation 2500 feet, April 27, 1953, *Muller and Tucker 9549, 9550*; along wash at elbow of south fork of Alamo Canyon, elevation 2800 feet, April 27, 1953, *Muller and Tucker 9535-9539*; north-facing canyon wall above east fork of south fork of Alamo Canyon, elevation 3200 feet, April 27, 1953, *Muller and Tucker 9540-9543*; north-facing canyon near head of south fork of Alamo Canyon, elevation 3500 feet, April 27, 1953, *Muller and Tucker 9544, 9545*; open, grassy north-facing slope in Alamo Canyon just below summit of ridge adjoining Arch Canyon, elevation 4000 feet, April 27, 1953, *Muller and Tucker 9546*; main (south) fork of Alamo Canyon (between 2375 and 2675 feet elevation) in sparse streamside woodland of *Forestiera*, *Simmondsia*, *Juniperus*, *Celtis*, *Vauquelinia*, *Acacia*, and *Prosopis* in the otherwise openly shrubby mountains, August 15, 1952, *Muller and Tucker 9518, 9519* (type, in the Muller Herbarium at Santa Barbara and widely distributed), *9520-9525*; April 17, 1952, *Parker 7998, 8002, 8003, 8010, 8011*; October 7, 1951, *Parker and Lowe 7726-7729, 7732, 7733*; May 21, 1947, *Phillips s. n.*

In addition to the specimens cited above, a series comprising a mass collection was taken from lower Alamo Canyon August 15, 1952 (*Tucker and Muller 2436-1 to 2436-36*).

*Quercus ajoensis* is abundantly distinct from *Q. hinckleyi* whose low rhizomatous shrub habit and smaller leaves with fewer teeth clearly set it off. Presumably, both species have suffered geologically recent restriction of range incident to the general dessication of the region since the last pluvial period (whence the serial name, *Relictae*). A very real practical difficulty exists, however, in drawing a distinction between *Q. ajoensis* and *Q. turbinella*. This involves no legitimate question concerning the specific distinctness of the two, but rather arises from (1) the occurrence of intermediates (presumably of hybrid origin) in the mountains of Yuma County, lying more or less between the ranges of *Q. ajoensis* and *Q. turbinella*, and from (2) the unmistakable presence of *Q. turbinella* characters in a few individuals at low elevations in the Alamo Canyon population itself. The following specimens were examined from Yuma County, Arizona. Castle Dome Mountains: about 36 miles south of Quartzite, south fork of canyon above Horse Tanks, about 1800 feet elevation, August 16, 1952, *Muller 9526-9531*. Kofa (S.H.) Mountains: about 28 miles south of Quartzite, Palm Canyon, about 2500 feet elevation, August 16, 1952, *Muller 9532-9534*; September 5, 1952, *Tucker 2616-1 to 2616-11*; at the head of Palm Canyon, April 29, 1953, *Tucker and Muller 2641-1 to 2641-10*; middle Palm Canyon, April 29, 1953, *Tucker and Muller 2642-1 to 2642-5*.

In the canyon above Horse Tanks in the Castle Dome Mountains, and 8 miles north in Palm Canyon in the Kofa Mountains, there grow small



FIG. 1 (top). *Quercus ajoensis* Mull., Muller and Tucker 9519, the type collection from the Ajo Mountains, Arizona. FIG. 2 (bottom). *Quercus turbinella* Greene, Clokey 7888, from the Charleston Mountains, Nevada.

populations (about 15 to 100 trees) of relatively uniform intermediacy between *Q. ajoensis* and *Q. turbinella*. In these the long spinose-aristate teeth and waxy glaucous leaf surfaces of *Q. ajoensis* are usually but variously combined with the stellate pubescence of the leaf surfaces, the yellow glandular puberulence of the lower surface, increased gray stellate tomentum of twigs and petioles, and the broader and more tomentose cups with broader acorns which are characteristic of *Q. turbinella*. From a cursory observation of general habit and gross appearance of the leaves, one would be inclined to refer these individuals to *Q. ajoensis*. However, upon careful examination, one is forced to the conclusion that *Q. turbinella* characters predominate in both of these small populations. In fact, some specimens (notably *Muller 9529* in the Castle Dome area and *Tucker and Muller 2641-3* in the Kofa Mountains) are almost typical *Q. turbinella*.

Dr. A. R. Phillips reported (verbal communication to Dr. Tucker) the presence of typical *Q. turbinella* on the ridge tops at the head of Alamo Canyon in the Ajo Mountains at about 4000 feet elevation. Phillips and Pulich (*Condor* 50:271, 1948) refer to this as "true scrub oak." However, no specimens of this population were taken prior to *Muller and Tucker 9544* and *9546* which proved to be shrub forms of pure *Q. ajoensis*. Seedlings (*Muller and Tucker 9543*) occur abundantly beneath parent trees on the high north-facing canyon walls in the Ajo Mountains. They reveal an extraordinary uniformity with the mature forms and no significant juvenile characters. The occasional presence in the lower Alamo Canyon population in the Ajo Mountains of golden puberulence on the lower leaf surface, of broad and densely tomentose cups, and of increased twig tomentum suggests a very dilute hybridity with *Q. turbinella*. In fact, the type of *Q. ajoensis* (*Muller and Tucker 9519*) exhibits some of these characters minutely. This, however, is definitely not of the order of intermediacy exhibited by the Yuma County population where *Q. ajoensis* as such does not occur. The biological situation revealed by these several populations will be elaborated in a separate, non-taxonomic paper.

Although taxonomists have for many decades regarded the occurrence of numerous intermediates in a given situation as disproof of the existence of more than one species, I submit that in this case the presence of intermediates may be interpreted as strengthening the evidence that two species are indeed involved. Were *Q. ajoensis* not abundantly different from *Q. turbinella*, its introgression of the Yuma County populations could not have made them so obviously different from typical *Q. turbinella* of farther north. Although *Q. ajoensis* is now nearing extinction, the only known population being that in the Ajo Mountains, its striking characters and the marked effect of these upon the adjacent populations of *Q. turbinella* are ample proof of its evolutionary status.

The recognition as species in the genus *Quercus* of morphologically well differentiated taxa, so long as some parts of their populations remain pure, is as justified in my opinion as is the recognition as species of forms nearing extinction through influences other than hybridization. I am

aware, of course, that some workers still insist that hybridization (actual or potential) with the production of fertile offspring is itself disproof of specific distinctness. This criterion, if rigidly applied to American *Quercus*, would probably reduce that multitudinous and extremely diverse assemblage to the ridiculous extreme of three "species", one for each of the subgenera.

University of California,  
Santa Barbara College, and  
Santa Barbara Botanic Garden.

## THE ALLOPOLYPLOID STIPA LATIGLUMIS<sup>1</sup>

RICHARD W. POHL

*Stipa latiglumis* Swallen is a rare endemic Californian species described originally by Swallen (1933) from Yosemite Valley. It is a tufted perennial, resembling in its gross morphology such common species as *S. californica* Merr. & Davy and *S. elmeri* Piper & Brodie. Like these two species, it has pubescent lemmas which have the hairs markedly longer at the summit, and awns which bear spreading or ascending hairs on the basal twisted segment. From the former species, it differs in having puberulent sheaths, and from both species by its rather wide glumes, as indicated by the specific epithet.

*Stipa latiglumis* has been collected in Yosemite Valley a number of times and is apparently not rare there. It is also known from the Sierra Nevada of Fresno County and from Mount San Jacinto in Riverside County. A list of all known collection localities is given at the end of this paper. In Yosemite Valley, *S. latiglumis* grows in scattered clumps on sandy or rocky soil at the foot of talus slopes at about 4,000 feet elevation, in mixed stands of oaks and coniferous trees. *Stipa elmeri* grows with it, but tends to occupy the sandy alluvial soils of the valley floor. *Stipa lemmonii* occurs on the talus above the valley floor. Thus *S. latiglumis* occupies a habitat somewhat intermediate between those of the other two species.

In the amount and length of foliar pubescence, width of leaf blades, number of ribs on the adaxial leaf surface, and shape of the floret, *S. latiglumis* is intermediate between *S. elmeri* and *S. lemmonii*. In other traits, *S. latiglumis* resembles either of the latter two species, as is shown in Table 1 and Figure 4. The only exceptions are in the length of ligule and length of lemma, in which *S. latiglumis* exceeds both of its parents. The high degree of morphological intermediacy and the intermediate habitat suggested that *S. latiglumis* might be of hybrid derivation from these two species.

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